

1 **We Claim:**

2

3 1. A system for generating solid state deuterium fusion heat at elevated system free  
4 energy states, corresponding to high deuterium chemical potentials, comprising:

5 • a pressure vessel reactor; said reactor having a void space; said void space  
6 containing a host metal and deuterium gas; said deuterium gas at  
7 elevated pressure within said reactor void space and dissolved in said  
8 host metal;

9 • a means of providing a vacuum in said reactor before said deuterium is  
10 introduced;

11 • means of controlling said reactor's temperature and said deuterium gas  
12 pressure;

13 • means of transferring the generated heat to a useful load.

14 3. The system of in claim 1, comprising:

15 • a means of permanently sealing said pressure vessel after introducing said  
16 deuterium.

17 4. The system of claim 3, comprising:

18 • inert filler material inside said pressure vessel to reduce said void space; said  
19 reduction in void space enhancing the deuterium gas pressure increase  
20 as the reactor temperature is increased.

21 5. The system of claim 1, wherein said host metal is palladium.

22 6. The system of claim 1, wherein said host metal is titanium.

23 7. The system of claim 1, wherein said host metal is nickel.

24 8. The system of claim 1, wherein said host metal is zirconium.

25 9. The system of claim 1, wherein said host metal is vanadium.

26 10. The system of claim 1, wherein said host metal is thorium.

27 11. The system of claim 1, wherein said host metal is lanthanum.

28 12. The system of claim 1, wherein said host metal is praseodymium.

29 13. The system of claim 1, wherein said host metal is tantalum.

30 14. The system of claim 1, wherein said host metal is uranium.

31 15. The system of claim 1, wherein said host metal is hafnium.

32 16. The system of claim 1, wherein said host metal is cerium.

33 18. The system of claim 1, wherein said host metal is in a powdered form.

34 19. The system of claim 1, wherein said host metal is in a solid form.

1 20. Using the system of claim 1, comprising:

2 a method in which deuterium gas chemical potentials in the range of 15 kJ/mol  
3 to 50 kJ/mol are produced at temperatures ranging from 400°C to 1500°C  
4 and at deuterium gas pressures ranging from 25 atmospheres to 2,000  
5 atmospheres.

6 21. Using the system of claim 3, comprising:

7 • a method in which deuterium gas chemical potentials in the range of 15 kJ/mol  
8 to 50 kJ/mol are produced at temperatures ranging from 400°C to 1500°C  
9 and at deuterium gas pressures ranging from 25 atmospheres to 2,000  
10 atmospheres.

11 22. A system for testing candidate host metals to determine their threshold deuterium  
12 gas chemical potentials and heat production rates comprising:

13 • a pressure vessel reactor; said reactor for containing said candidate host metal  
14 and deuterium gas under pressure;

15 • a heater surrounding said reactor;

16 • a means of providing a vacuum in said reactor before said deuterium is  
17 introduced;

18 • a system design that minimizes heat transfer away from said candidate host  
19 metal and heat transfer away from said reactor;

20 • a probe for supporting said host metal in said reactor;

21 • a temperature sensor in the end of said probe;

22 • means of measuring said deuterium gas pressure and said reactor  
23 temperature;

24 • means of controlling said reactor temperature and said deuterium gas  
25 pressure;

26 • a means of measuring the heat generation rate within said host metal.

27 23. Using the system of claim 22, comprising:

28 • a method in which said deuterium gas chemical potentials in the range of  
29 15kJ/mol to 75kJ/mol are produced at temperatures ranging from 400°C to  
30 3000°C and at deuterium gas pressures ranging from 5 atmospheres to  
31 4000 atmospheres.

32 24. Using the system of claim 22, comprising:

- a method in which the said threshold deuterium gas chemical potential at the onset of said heat generation is determined for said candidate host metal.

